METI
Ministry of Economy, Trade and Industry

Energy White Paper 2020 (Summary)

June 2020

Agency for Natural Resources and Energy

Energy White Paper 2020

- The Energy White Paper is an annual report based on the Basic Act on Energy Policy (statutory white paper). The 2020 version is the 17th publication since its first release.
- The White Paper has been historically comprised of 3 parts, namely Part 1: Analysis based on the current energy situation, Part 2: Data on energy trends at home and abroad, and Part 3: Measures taken. The composition of the 2020 version (draft) is as follows:

■Composition of 2020 version

Part 1 Current Energy Situation and Key Measures

Chapter 1 Progress of reconstruction of Fukushima

1. Efforts made to cope with the accident at Fukushima Daiichi Nuclear Power Station
2. Support for victims of the accident
3. Fukushima plan for a new energy society
4. Nuclear damage compensation

Chapter 2 Enhancement of resilience of energy systems based on risks associated with disasters and geopolitics

1. International resource strategy based on risks associated with disasters and geopolitics
2. Establishment of sustainable power systems
3. Renewable energy to be a main source of electricity
4. Enhancing energy resilience

Chapter 3 Measures to cope with the effectuation of the Paris Agreement

1. Trends in global warming countermeasures
2. Trends in energy finance
3. Environmental Innovation Strategy to be formulated and implemented

Part 2 Energy Trends

Chapter 1 Domestic energy trends

1. Energy supply and demand
2. Energy consumption by sector
3. Primary energy
4. Secondary energy

Chapter 2 International energy trends

1. Energy supply and demand
2. Primary energy
3. Secondary energy
4. Comparison of energy costs by country

Part 3 Measures Taken in FY2019 concerning Energy Supply and Demand

Chap.1 Comprehensive measures to secure a stable supply of energy

Chap.2 Smarter and more flexible consumption in a society of enhanced energy efficiency

Chap.3 Renewable energy to be a main source of electricity

Chap.4 Nuclear policy deployment

Chap.5 Environment in which fossil fuels can be utilized efficiently and stably

Chap.6 Supply structure reform with cross-market transactions

Chap.7 Resilience of domestic energy supply network

Chap.8 Resilience of energy system and structural reform toward new types of secondary energy such as hydrogen

Chap.9 Comprehensive international cooperation on energy

Chap.10 Strategic technological development

Chap.11 Enhancing public awareness on energy by close communication

(Reference) Changes of Topics in Part 1 of White Paper

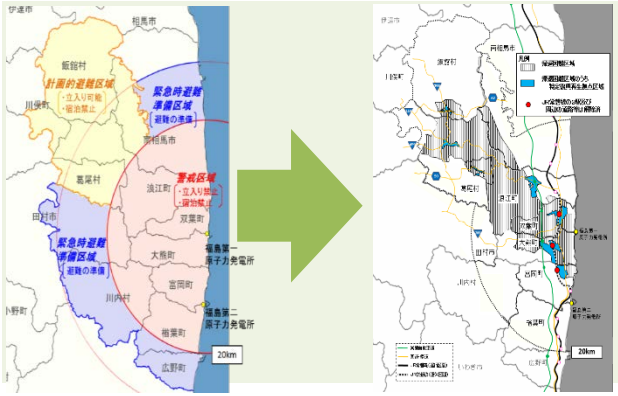
- Part 1, analyzing the latest trends, characterizes each year's White Paper.

Part 1	Chapter 1	Chapter 2	Chapter 3
2020 (Draft)	**Progress of the Reconstruction of Fukushima**	**Resilience of Energy System based on risks associated with disasters and geopolitics**	**Measures to cope with the effectuation of the Paris Agreement**
2019	Reconstruction of Fukushima	Global warming countermeasures and energy policy based on the Paris Agreement (long-term strategy)	Recent disaster response and efforts toward the enhancement of energy resilience
2018	Historical evolution of the energy situation in Japan since the Meiji Restoration	Progress of the reconstruction of Fukushima	Energy situation at home and abroad and varying challenges (Basic Energy Plan/Discussion Meeting)
2017	Progress of the reconstruction of Fukushima	New development of energy policies (JOG, FIT, Retail market liberalization)	Energy system reform and enhancement of competitiveness of the energy industry
2016	Energy security in the era of cheap crude oil prices	Response to the accident at Fukushima and formulation of nuclear policy based on the lessons learned	Energy Policy reform based on the Paris Agreement (energy mix)
2015	"Shale Revolution" and changes in the world energy situation	Response to the Great East Japan Earthquake and the accident at TEPCO's Fukushima Daiichi NPS	Response to the cost of energy

Chapter 1 Progress of the Reconstruction of Fukushima

	2011 Right after accident	2020 9 years after accident	Future

Off-site



-In March 2020, evacuation orders were partially lifted for towns of Futaba, Okuma and Tomioka, first among areas where returning is difficult.
-Furthermore, evacuation orders were lifted in all areas except for the areas where returning is difficult.

Aiming to lift evacuation orders for the whole of the Specified Reconstruction and Revitalization Bases in 2022-2023.

Environment for returning evacuees

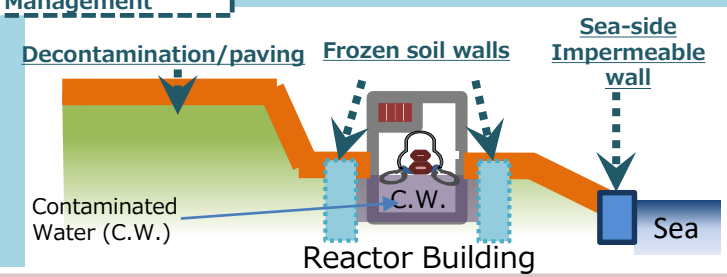
-Promoting Fukushima Innovation Coast Framework
-Industrial reinvigoration in Hamadori area
-Reconstructing business / livelihood
-Eliminating reputational damage to agricultural and marine products
-The establishment of Specific Reconstruction and Revitalization Bases.

Contaminated Water

App. 10,000 Bq/L (March 2011)

*Concentration of radioactive material (Cesium 137) in the sea around the site

Contaminated water Management



Reduced to less than one 10,000th by contaminated water management

Decommissioning

Actions toward decommissioning continued

Mid and long-term Roadmap (ver.1) published (Dec. 2011)

Research Institute for Decommissioning (IRID) established (Aug. 2013)

Public support institute (Nuclear Damage Compensation and Decommissioning Facilitation Cooperation) established (Aug. 2014)

Policy toward fuel debris retrieval determined (Sept. 2017)

In an Investigation of Unit 2 we're able To grip deposits (Feb. 2019)

Determination of method for fuel debris retrieval from first implementing Unit. (Dec. 2019)

Reconstruction Sustainable Measures Decommissioning

Efforts recently made toward reconstruction and reinvigoration of Fukushima

On-site

✓ **Revision of the Mid and Long-Term Roadmap**

- Revised in Dec, 2019. Setting out a basic principle of "coexistence of reconstruction and decommissioning", Unit 2 was selected as the first implementing unit for fuel debris retrieval.

✓ **Preventive/multi-layered contaminated water management**

- By frozen soil walls and sub-drains, amount of contaminated water generated was reduced from app.540m3/day (May 2014) to app.180m3 (FY2019).

✓ **Fuel removal in progress**

- Fuel removal from Unit 3 has been in progress since April 2019.

✓ **Investigation toward fuel debris retrieval**

- The inside of Unit 2 reactor containment vessel was investigated in January 2018 with fuel debris-like deposits confirmed. In February 2019, a device contacted and moved the deposits shaped like pebbles.

✓ **Dismantling of exhaust pipes Nos. 1 and 2**

- To secure anti-earthquake tolerance, work started in August 2019 to dismantle 60 meters of upper parts of the exhaust pipes and completed on May 1, 2020.

✓ **Progress confirmed by international organization (IAEA)**

- The 4th review mission of IAEA experts was received in November 2018.
- Their statement was as follows: "The transition from emergency to steady state has been achieved at Fukushima Daiichi NPS, and it has been evaluated that there have been many improvements since the previous review (February 2015)."
- In April 2020, the IAEA reviewed the situation with the ALPS-treated water stored in tanks based on the report compiled by the ALPS sub committee.

Off-site

✓ **Lifting of evacuation orders/the establishment of Specific Reconstruction and Revitalization Bases**

- In March 20, evacuation orders were partially lifted for towns of Futaba, Okuma and Tomioka, first among areas where returning is difficult.
- Furthermore, evacuation orders were lifted for all areas except for the areas where returning is difficult.
- Aiming to lift evacuation orders for the whole of the Specified Reconstruction and Revitalization Base in 2022-2023, the environment for returning evacuees is being improved.

✓ **Opening of Fukushima Robot Test Field**

- Research building, Mockup plants, Mockup tunnels, Airfield surrounded by net, etc. have been opened since July 2018. The Test Field was fully opened in March 2020.

✓ **Improvement of living environment**

- Elementary and junior high schools have been established or resumed since April 2018. Schools were resumed in many municipalities with evacuation orders lifted.
- The living environment is improving for returning evacuees with secondary emergency medical facilities and fire stations reopened.

✓ **Demonstration of hydrogen from renewables**

- In Namie town, demonstration projects are underway for the production of hydrogen from renewable energy using the world's largest water electrolyzer.
- The "Fukushima Hydrogen Energy Research Field" was inaugurated in March 2020.

Chapter 2 Resilience of energy system based on risks associated with disasters and geopolitics

1 International resource strategy based on risks associated with disasters and geopolitics

(Changes in the resource situation)

-LNG/LPG: Increasing presence of new producers such as USA and Russia/expanding demand by Asia (Japan's influence in the market relatively decreased.)

-Oil: The situation in the Middle East becoming tense

-Metals/minerals: Increasing demand for rare metals. Market control and export restrictions by China

- -Further diversification of supply (Non-Middle East)
- -Bringing together Asian demands for LNG/LPG. Strengthening security through the expansion of international markets.
- -Fortifying the system of petroleum reserves
- -Securing rare metals and reserves, key to the industrial competitiveness
- -Strengthening security for all Asia through cooperative reserves as well as tripartite trade

2 Establishment of sustainable power systems

(Structural changes in power networks)

-Renewables to be a main source of electricity (regional unevenness)

-Resilience against disasters

-Obsolete facilities

-Digitalization (two-way flow of electricity)

-Difficulties in demand forecast due to decreasing population

- -Renovating the electrical power network (push-based creation of power grids, reinforcement of Interconnection facilities between Hokkaido and Honshu, Connect and Manage at demand side)
- -Restraint on and leveling of financial burdens to the public
- -Reforms in wheeling fees (cost control, better investment environments)
- -Shifting to the next-generation power systems
- -Disaster response (securing budget, allotment of roles)

3 Renewable energy as a main source of electricity

(Challenges foreseen)

-Reduce generating costs closer to the international standards. Secure independence from FIT scheme.

-Secure long-term, stable operations of businesses.

-Cope with limited suitable locations, network development/operation, variable outputs

- -Source-specific support measures (promoting supply-demand combined model, proper introduction of approved businesses, control of financial burdens to the public)
- -Business discipline (an external reserve fund for solar PV facilities disposal costs, stricter discipline in terms of safety)
- -Creation of a next-generation electric power network that will support large-scale introduction of renewable energy push-based systematic creation of power grids, cost bearing for power grids reinforcement, expansion of renewable generators subject to curtailment)

4 Enhancing energy resilience

(Circumstances surrounding Energy resilience)

-Natural disasters (more severe and wider)

-Geopolitical risks emerging. Changes in demand structures.

-Renewable energy to be a main source of electricity (pursuing both its maximum introduction and the restraint on financial burdens to the public)

-Disasters striking frequently and severely worldwide

- -Bill for Energy Resilience Act
- >Electricity Business Law (reinforcement of cooperation for disasters, transmission/distribution network, distributed electrical power systems resilient to disasters, etc.)
- >Renewable Energy Special Measures Law (establishment of FIP scheme, grid fortifying to take advantage of the potential of renewables, proper disposal of renewable generation facilities)
- >JOGMEC Act (emergency procurement of fuels for power generation, risk money supply)
- -International discussions toward enhancing energy resilience (APEC, etc.)

(Topic) Changing International Resource Situations

- **Concerns about climate change are growing.** As several international organizations publish different forecasts of the future of fossil fuels, **uncertainties arise about the long-term picture of energy.**
- Since the fall of oil prices in 2014, **energy markets have been increasingly unstable. Investments in fossil fuels have decreased and are stagnant.**
- In order to satisfy the growing demand for energy mainly by emerging nations, **fossil fuels are still necessary.** Huge investments on a long-term basis are required for the development of fossil fuels (with 3,000 trillion yen estimated for 30 years from now). **As there are uncertainties in expecting returns from such investments, it is difficult for corporations to make decisions.**
- In September, 2019, **the United States** became a **net exporter of crude oil and petroleum products for the first time in the monthly statistics**. The involvement by the USA in the Middle East decreases, which **changes the geopolitical balance**. It affects **the energy security of Japan** which depends 88% on the Middle East for the crude oil supply.
- It is necessary to reinforce the resource strategies in the rapidly changing international resource situation. Measures to be taken include **oil reserves jointly held with Asian countries or oil producing nations**, and **increased trading in the international LNG markets with liquidity and flexibility secured**.

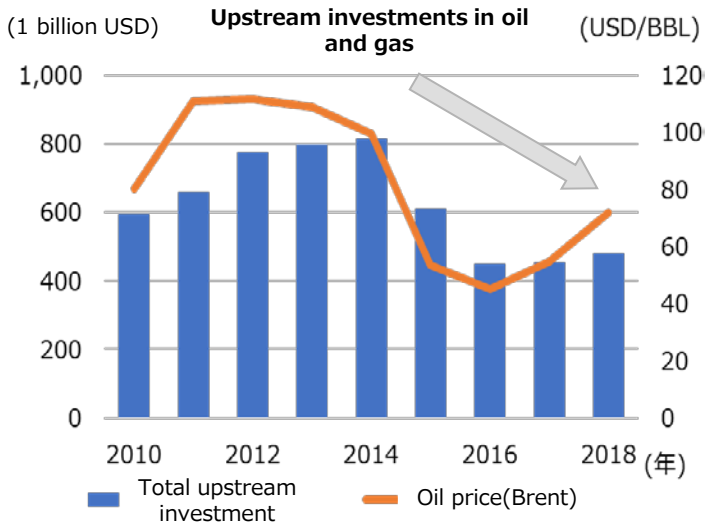
Long-term forecast of ratios of demand for fossil fuels
-varying forecasts due to growing concerns about global warming

Forecasts of ratios of fossil fuels in the world's primary energy demand

		fossil		coal		oil		gas	
	scenario	Current	2040	Current	2040	Current	2040	Current	2040
IEA	Stated Policies	81%	74%	27%	21%	31%	28%	23%	25%
	Sustainable Development		58%		11%		23%		24%
BP	Evolving transition	85%	73%	28%	20%	34%	27%	23%	26%
	Rapid transition		57%		7%		23%		26%
Exxon Mobil	base	81%	76%	26%	20%	32%	30%	23%	26%
	2℃		61%		11%		24%		25%
IEE Japan	Reference	81%	80%	27%	24%	32%	30%	22%	26%
	Technological progress		72%		19%		29%		25%

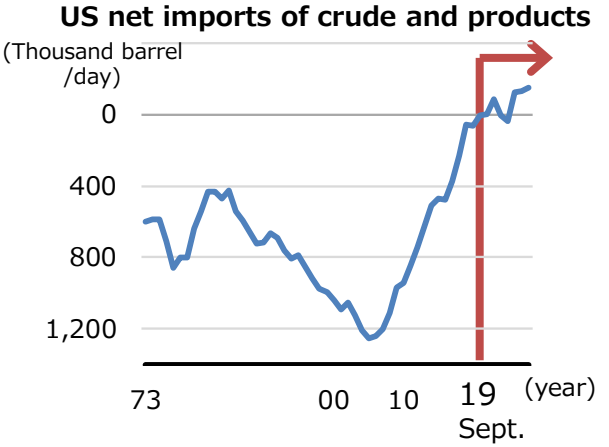
Source : IEA "World Energy Outlook 2019」" and other forecasts published by respective organizations

Since the fall of oil prices in 2014, investments have decreased
-investments necessary for stability of energy markets



Source: IEA "World Energy Investment 2020"

USA as net exporter of crude and petroleum products
-**change in geopolitical balance**, Japan should prepare



Source: EIA "Monthly Energy Review"
* Annual data till 2020. Monthly data from Jan.-Sept. Calculated using aggregate weekly data thereafter.

(Topic) Covid-19 Pandemic Impact on the International Crude Oil Market

- From January to February 2020, **oil prices dropped due to a decline in its demand caused by the spread of Covid-19**.

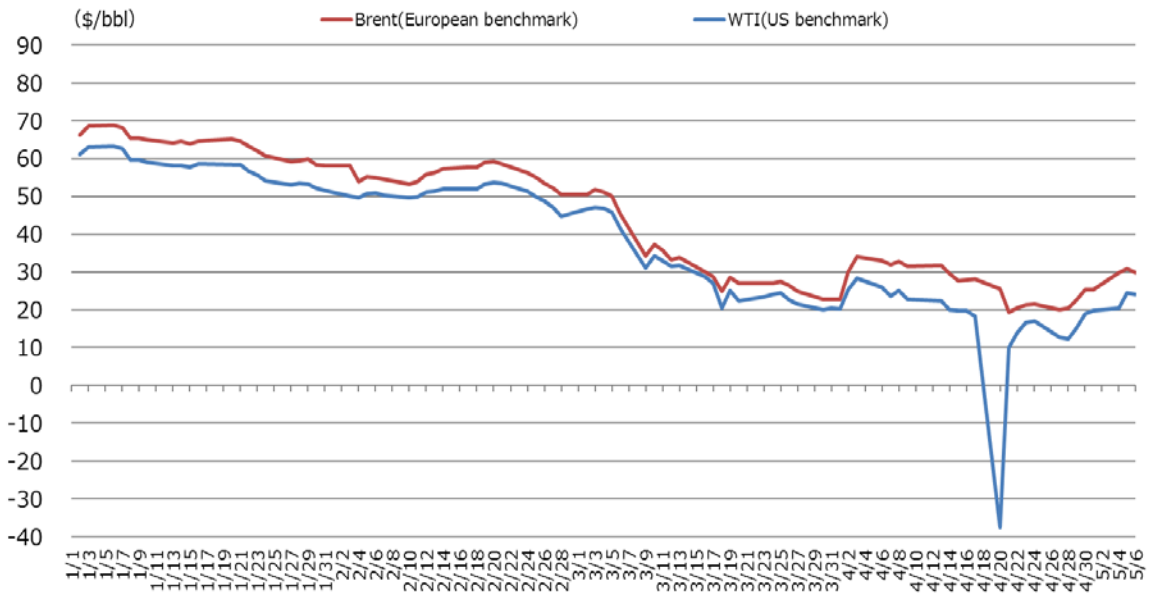
- At the OPEC and OPEC-plus Ministerial Meeting held on March 6, **the member countries were in fierce disagreement regarding production cuts and negotiations eventually collapsed. Ultimately**, **some countries announced a substantial increase in their production, and this intensified price competition.**

- On April 10, **for the purpose of promoting cooperation in the stabilization of the international oil and gas market, the G20 Extraordinary Energy Ministers Meeting was held.** On April 12, **the OPEC-plus ministers agreed on a massive production cut.**

- From the middle of April, however, a **further decline in oil demand drove down crude oil prices.** The front-month price of WTI, US crude benchmark, plummeted to a record low, namely minus 37.63 dollars per barrel, as the result of anticipated storage capacity constraints.

- From the beginning of May, **in accordance with the resumption of economic activities in some Western countries, international crude oil prices have been recovering.**

Crude Oil prices since Jan. 2020



2020→

Source: CME

Securing stability of international crude oil market

- Low crude oil prices will enable consuming countries to improve their trade balances and enjoy lower prices of oil products.
- On the other hand, a sharp decline in oil prices will impact on the profitability of energy companies as well as economies of oil producing countries. This may jeopardize a stable supply of oil and gas on a mid to long term basis.

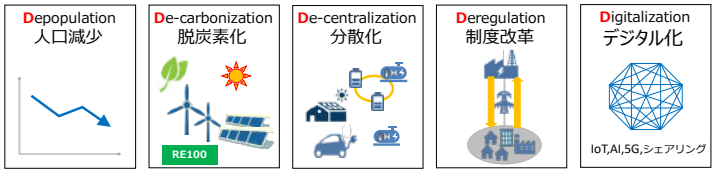
- A stable supply of energy is essential to a recovery of the global economy which is currently in crisis.
- Major producers and consumers are urged to work together to stabilize the international crude oil market.

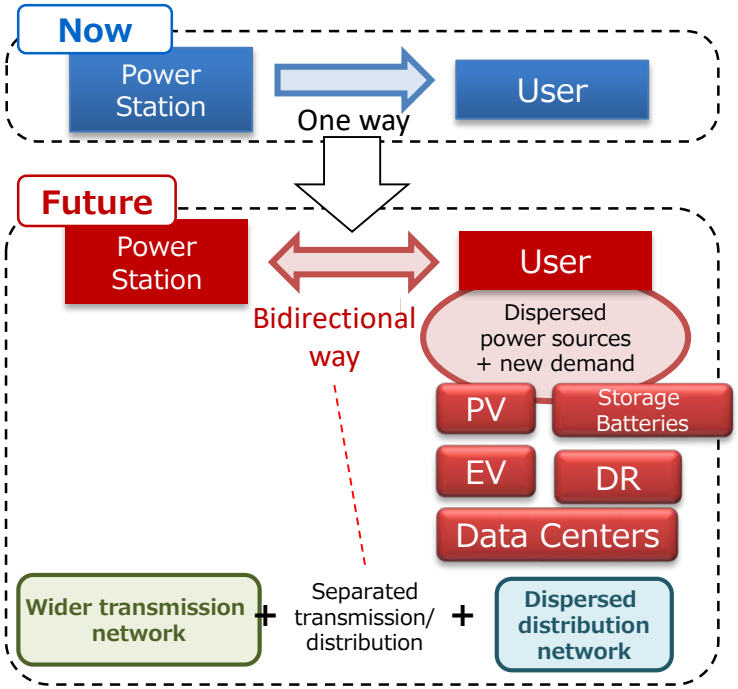
(Topic) Two-Way Flow of Electricity and Emerging New Energy Business

- To enhance **resilience** of power systems against natural disasters, the utilization of **dispersed power sources** is one of the effective options.
- **The flow of electricity will become two-way.** There will be **increasing demand for electricity** by electrified vehicles, storage batteries and data centers. Combining these as well as residential photovoltaic generation outside the FIT scheme, **a new system to coordinate a supply and demand balance** will be feasible.
- **The sophistication of digital control technologies such as VPP and DR**, **new business opportunities** will emerge involving various sectors.

5 structural changes (5D)
Flow of electricity to become two-way

Digital control of dispersed power sources will sophisticate coordination capabilities and create new businesses

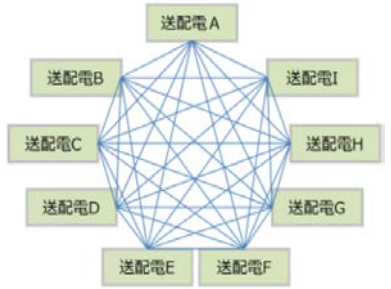




New supply and demand coordination system

Now : Mutual coordination by distribution companies

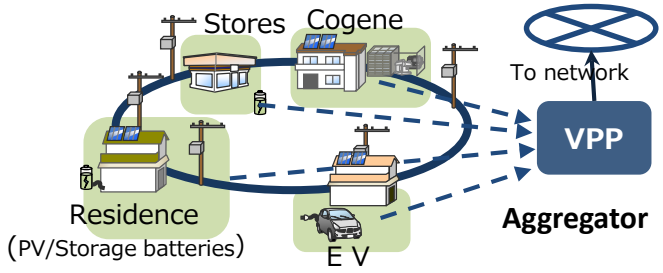
Widened from 2021



Future : Nationwide trading through the market

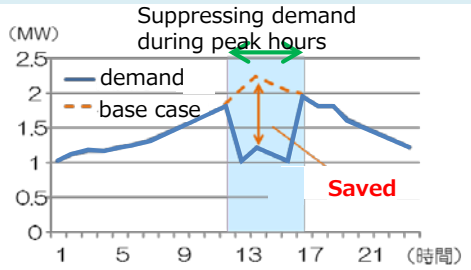
New businesses

Virtual Power Plant (VPP): To digital control and consolidate small dispersed facilities to provide supply capabilities similar to a large scale power station.



Demand Response (DR)

Price increases during peak hours make the demand pattern change to meet the supply capabilities efficiently.



Chapter 3 Measures to cope with the effectuation of the Paris Agreement

1

Trends in global warming countermeasures

- Japan submitted the "Japan's Long-Term Strategy under the Paris Agreement" and "NDC" to the United Nations in June, 2019 and in March, 2020 respectively. According to NDC, Japan is pursuing further reduction of greenhouse gas emissions beyond its target of a 26% reduction by FY2030.
- It is critical to employ effective countermeasures for emerging nations to make efforts toward the reduction of their GHG emissions, which account for two-thirds of total GHG emissions worldwide. Japan will contribute to their efforts by offering its high-efficiency/low carbonized technologies as well as innovations such as carbon recycling.

2

Trends in energy finance

- In order to meet the targets set by the Paris Agreement, investment as much as 8,000 trillion yen will be necessary by 2040 (estimated by the International Energy Agency). The areas in which such investment is required are diverse, covering almost all areas such as energy efficiency, renewable energy, fuel conversion, nuclear energy and carbon recycling.
- It is necessary to concentrate funds on enterprises tackling the challenges of climate change and innovation.
  In October, 2019, the "TCFD Summit" was held in Tokyo bringing together top executives of industrial enterprises and financial institutions from across the world. It is necessary to offer a group of technologies which promote economic development in Asia and contribute to transition towards a low-carbon society.

3

Environmental Innovation Strategy to be formulated and implemented

- In January 2020, the "Environmental Innovation Strategy" was formulated.
- The strategy is comprised of the following 3 parts:

1) Innovation Action Plans: With regard to 5 areas, 16 technological challenges and 39 themes which have the potential to reduce GHG, the targets for costs, the roadmaps for technological development and the structure for implementation are to be clarified.
2) Acceleration Plans: proposes R&D structures and investment promotion to realize the above 1).
3) Zero-Emission Initiatives: Information dispatch and sharing with global leaders toward implementation in society

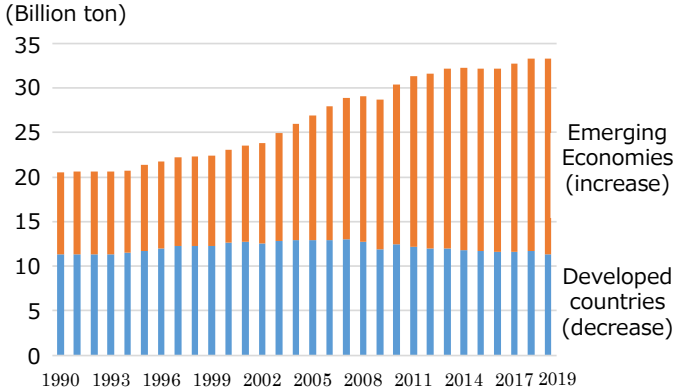
- This strategy also aims to reduce CO2 that were emitted in the past (Beyond Zero).

(Topic) A New perspective necessary for the effective reduction of GHG emissions globally

- While **advanced countries steadily reduce CO2 emissions**, emerging nations continue increasing emissions. Therefore, **worldwide emissions are not decreasing**.
- **Advanced countries, which do not have sufficient domestic manufacturing facilities, import carbon-intensive products from emerging nations**. This is partly **the reason for increasing CO2 emissions**, the scale of the increase estimated to be **10 to 20 % of total emissions worldwide** (6 billion tons which is **twice as emissions from EU countries**).
- CO2 emissions are currently attributed to producing countries. If they were recalculated with those emissions shifted to consuming countries, **the reduction rates in Europe would become smaller**, with Japan ranked No.1 among G7 nations in terms of reduction rates. (compared with 2013, as of 2015).
- In order to effectively reduce CO2 emissions globally, it is essential, in addition to domestic measures, to **decrease carbon footprints of emerging nations as exporters of industrial products**.
  Japan is to contribute to the global reduction of GHG emissions by leading **innovations** such as **high-efficiency/low carbonization technologies** and carbon recycling.

World CO2 emissions derived from energy

While Emissions have been reduced in advanced countries, worldwide emissions are not decreasing.

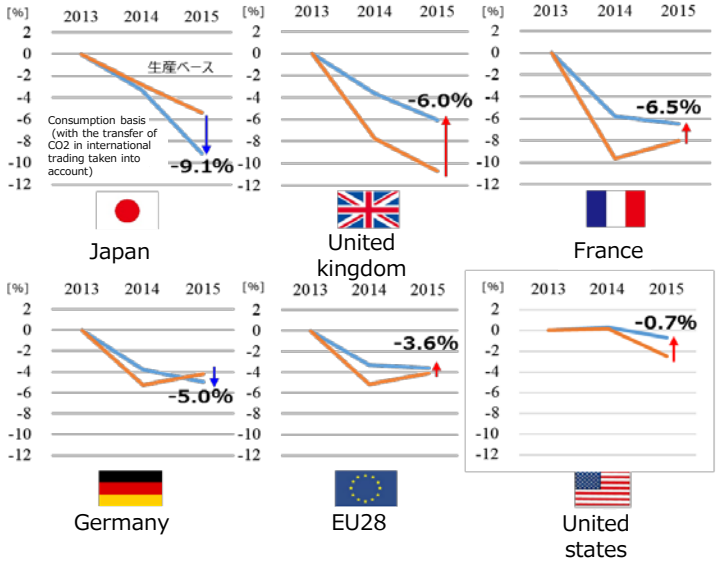


Source: IEA "Energy-Related CO2 Emissions"
(Note) Developed countries include Australia, Canada, Chile, EU, Iceland, Israel, Japan, ROK, Mexico, Norway, New Zealand, Switzerland, Turkey and USA.

CO2 emissions associated with exports from emerging nations account for 22%[1] to 7% [2].

In different counting method, reduction rates in Europe become smaller

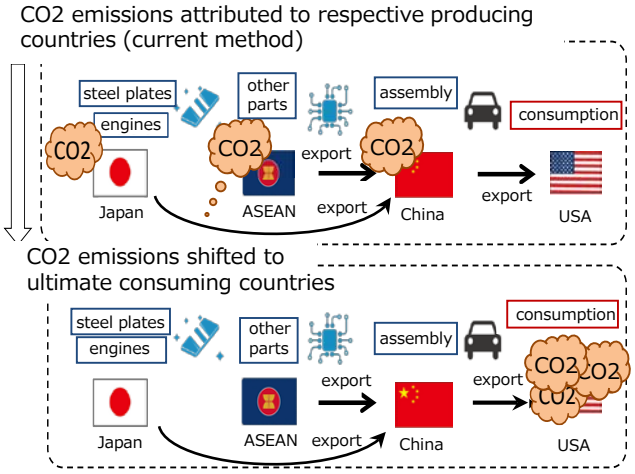
(as of 2015*, compared with 2013)



- Source: created from OECD "CO2 emissions embodied in international trade" (2019)

Comparison of CO2 counting methods

Simulation in the international automobile supply chain



- Source: created with reference to OECD "OECD CO2 emissions embodied in consumption" (2016)

[1] Peters, G. P. et al., "A synthesis of carbon in international trade", Biogeosciences, 9, 3247–3276, 2012.
[2] OECD, "CO2 emissions embodied in international trade", 2019.